National Aeronautics and
Space Administration

John F. Kennedy Space Center

SPACEPORT
ENGINEERING AND
TECHNOLOGY

# An Overview of Advanced Data Acquisition System (ADAS)

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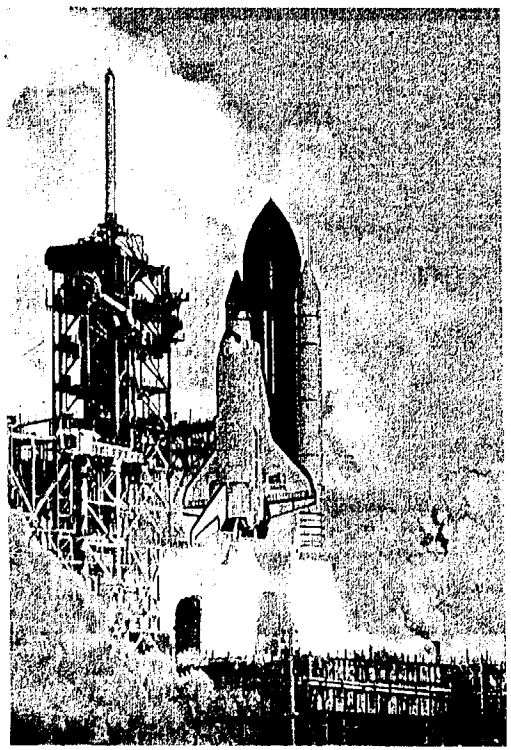
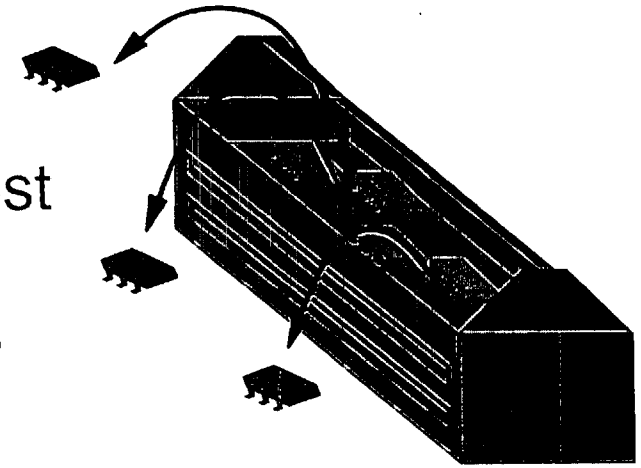
# Historical Background

- Aerospace industry requires highly reliable data acquisition systems
- Traditional systems employ end-to-end hardware and software redundancy
- Typically, redundancy adds weight, cost, power consumption, and complexity
- A single component failure may render the redundant path useless



# What is ADAS?

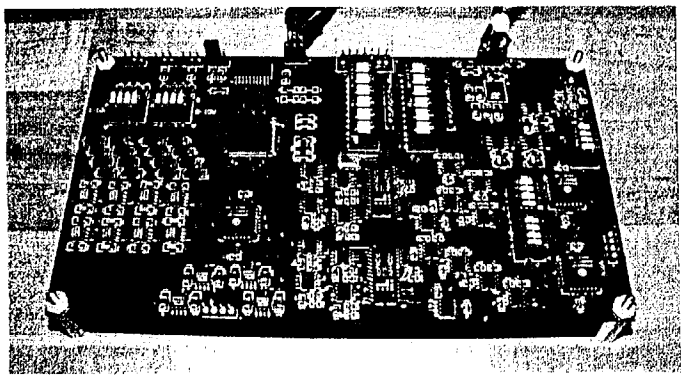
- ADAS is an intelligent, self-calibrating, self-healing, highly reliable, and cost effective multi-channel data acquisition system
- Reliably maintains data integrity at a reduced weight, size, and cost
- The architecture provides a "*spare part toolbox*" approach for identified critical components



- Number of spare components in the toolbox is based on their proneness to failure

# R & D Status

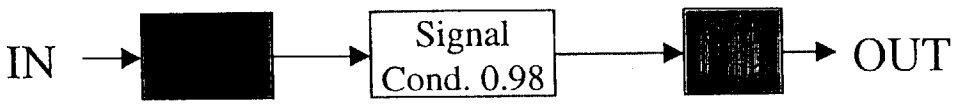
- Development stage
  - Architecture was defined
  - First prototype built
  - System components, component interfacing, and user interface tested
  - Preliminary software developed
  - System demonstration



- Technical considerations
  - Hardware limitations
  - Reliability optimization is based on application specifics
  - Reliability/flexibility vs. complexity trade-offs

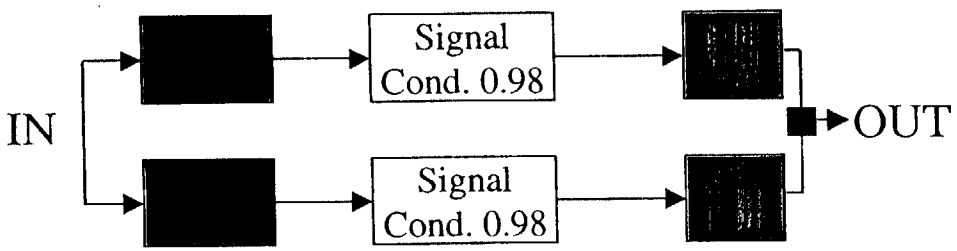
# Reliability/Cost Examples (1)

## One channel, non-redundant




Reliability = 0.99*0.98*0.96 = 0.9314
Cost = 1X, failure rate = 6.86%

## One channel, traditional end-to-end redundant

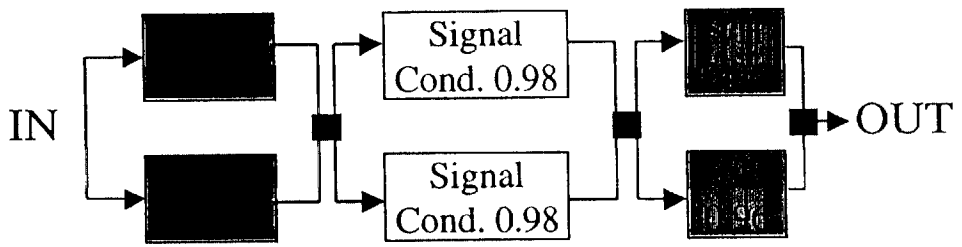



Reliability = (1-(1-0.9314)^2) = 0.9953
Cost = 2X, failure rate = 0.47%
Improvement factor = 14.57

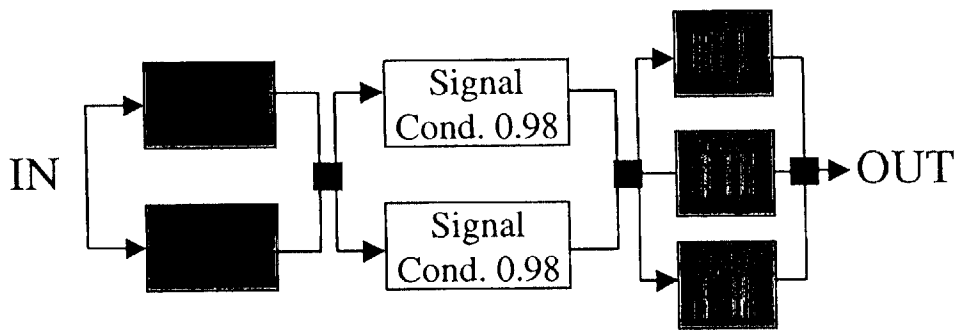
***Component reliability factors for demonstration purposes only**

# Reliability/Cost Examples (2)

## Novel ADAS approach (single channel)



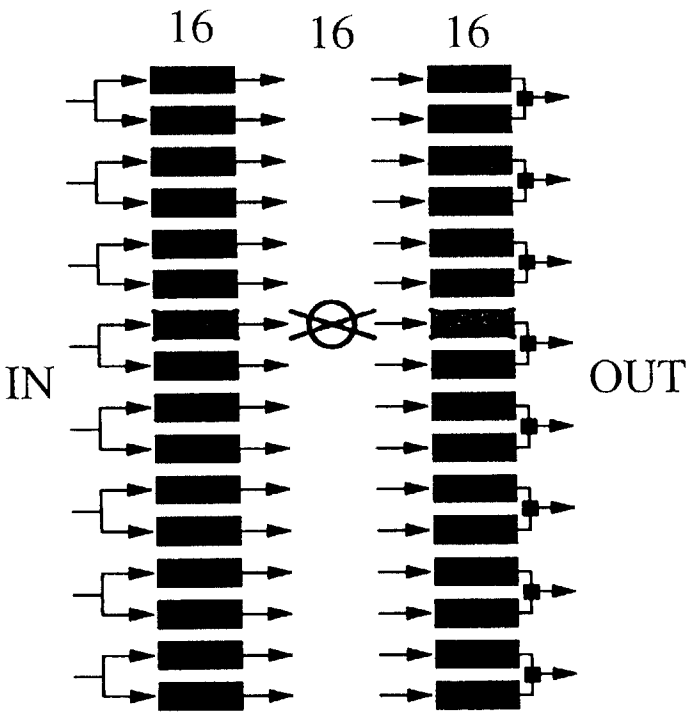

Reliability = 0.9979
Cost = 2X, failure rate = 0.21%
Improvement factor = 32.68



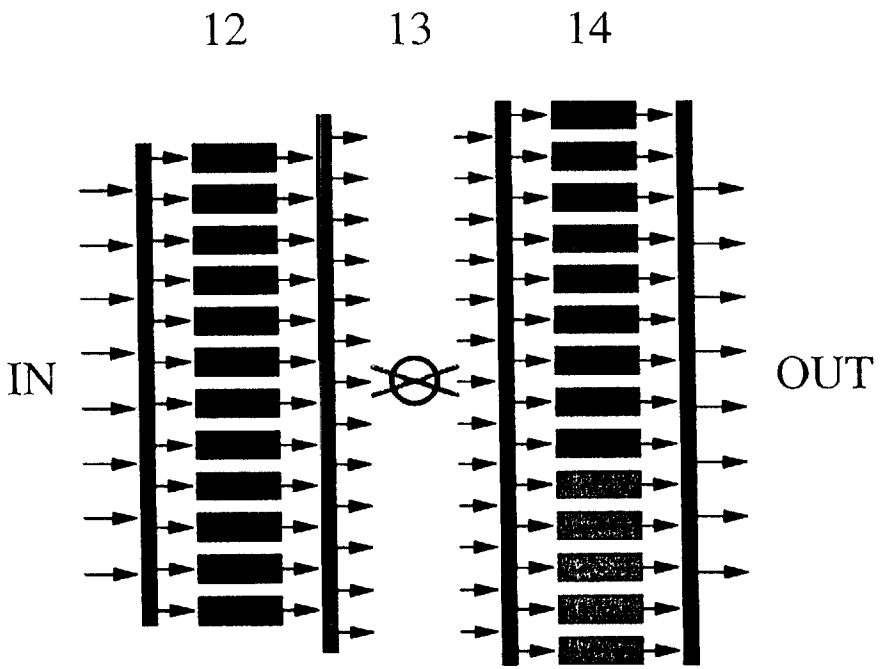

Reliability = 0.9994
Cost = 2X+, failure rate = 0.06%
Improvement factor = 121.66

# Reliability/Cost Examples (3)

Eight-channel Traditional end-to-end redundancy

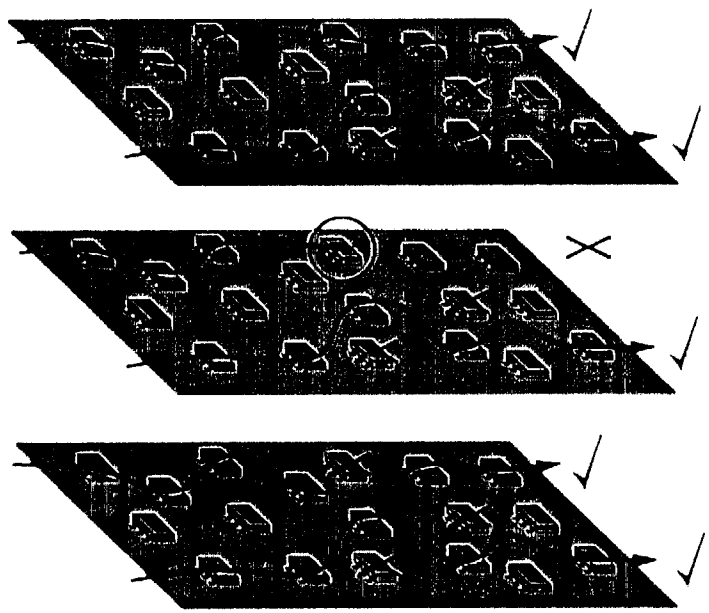



Eight-channel ADAS redundancy



# What's New?

- Redundancy at the component level minimizes component count (toolbox approach)
- Enhanced flexibility
- Autonomously re-configurable
- Higher reliability at a reduced weight, size, and cost
- Smart power management will minimize unnecessary power consumption



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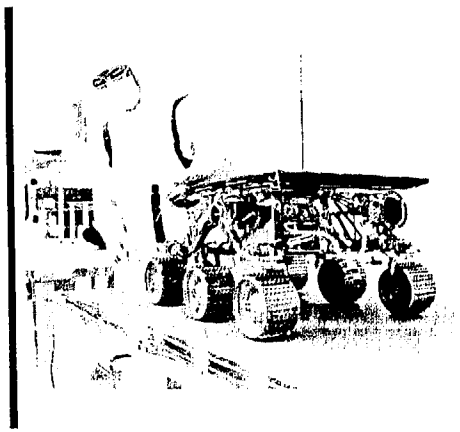
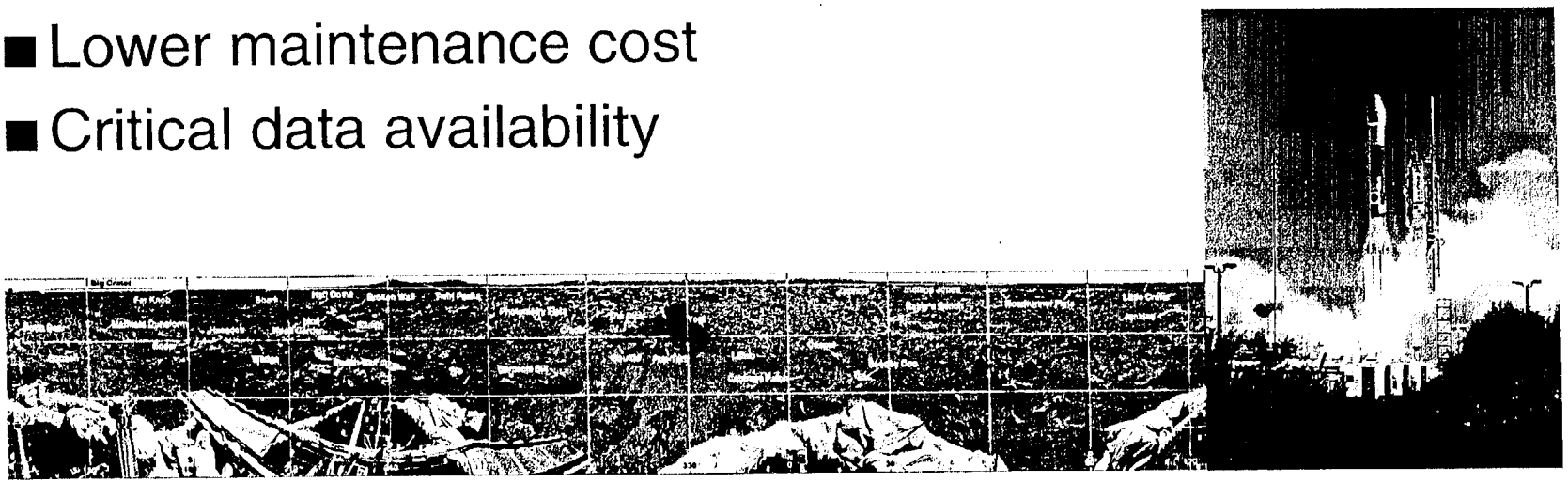
# Technical Advantages

- Fault tolerant system
  - Fast recovery
  - Minimal data interruptions
- System health monitoring and management
- Detection of system degradation (proactive prevention of failures)
- Optimized power consumption



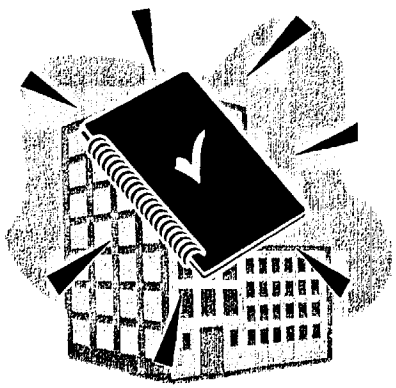
# NASA Relevance

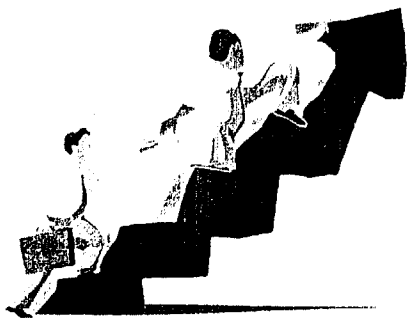
- Long duration flight instrumentation
- Automated remote system operation
- Higher reliability at a reduced weight, size, and cost
- Lower maintenance cost
- Critical data availability



# NASA Plans/Options

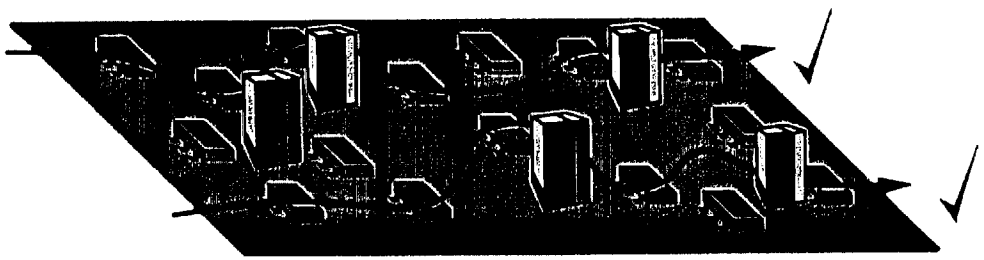
- Internal development
- Partnering for commercial development
- Patent/licensing of technology





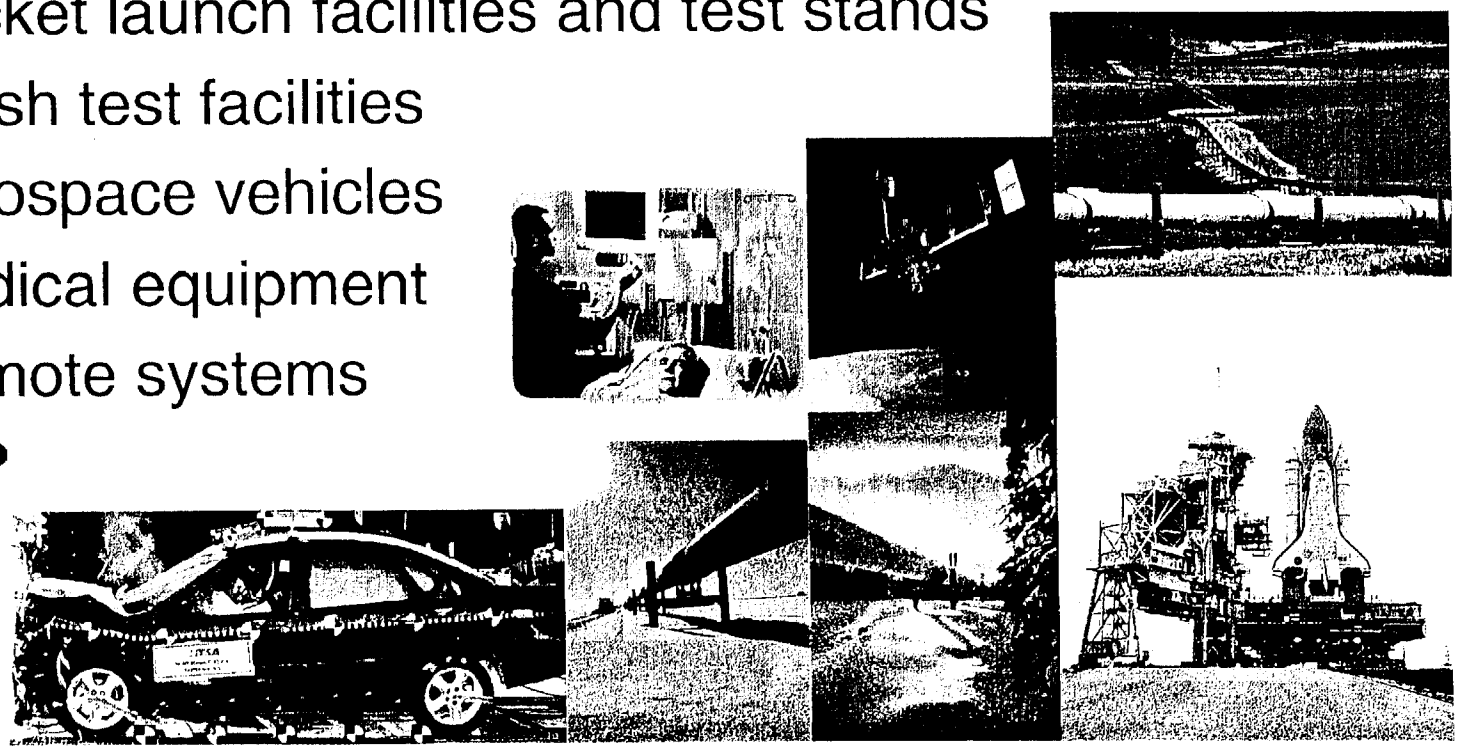
# Remaining R&D

- Embedded-distributed redundant intelligence
- Digital and control lines redundancy
- Assessment of reliability vs. complexity
- Smart power management



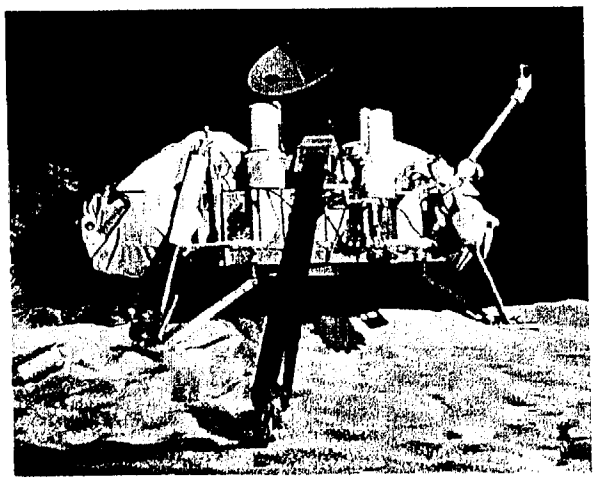
# Applications

- Industrial and manufacturing process monitoring
- Rocket launch facilities and test stands
- Crash test facilities
- Aerospace vehicles
- Medical equipment
- Remote systems
- ???



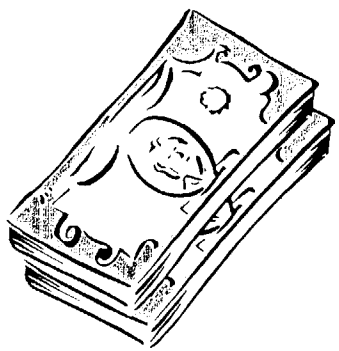
# Product Benefits

- Maintains signal integrity (improved reliability)
- Reduces weight, size, and cost
- Self-calibration assures accuracy even in extreme environmental conditions
- Smart power management optimizes energy consumption



# Commercial Advantages

- Dictates new trends for highly reliable electronic circuits
- Supersedes the traditional end-to-end hardware and software redundancy approach
- Higher reliability at a reduced cost
- Lower maintenance expense



# Intellectual Property

- NASA case number KSC-12301
- Patent pending
- Technology available for licensing

# Short-Term

- For further information contact...

# Long Term

- Feedback from RTI...